Poverty profoundly influences how children learn at home and at school.[1,2,3] Socioeconomic status (SES)-based language disparities are apparent in infancy,[1-3] and the "language gap" increases with age. Early intervention is crucial,[1-3] but the relation between *language input* (i.e., hearing speech) and *language learning* (i.e., vocabulary growth) is not as simple as 'words in => words out.' Recent research shows *language processing efficiency* (i.e., speed and accuracy in comprehension) mediates the relation between language input and language learning.[4] This was a pivotal result, but an alternative model may better explain how learning disparities arise via processing disparities. **I hypothesize that another mechanism – *predictive language processing* – underlies SES-based language disparities, in accordance with a prediction-based model of language learning.[4]**

According to this model, infants use predictive language processing (i.e., predicting upcoming input) as a language learning mechanism.[4] Consider an example: Prediction kills two birds with one stapler. When the predicted input (stone) doesn't match the actual input (stapler), this creates a prediction error. Errors influence learning by directing attention and modifying future processing.[4] When there is no mismatch, prediction increases language processing efficiency. A prediction-based model thus includes two mechanisms which may underlie learning disparities: language processing efficiency,[1-2] and predictive language processing.[4] Language processing efficiency is known to mediate the input-learning relation,[1] but this study will be the first to test whether predictive language processing is also a significant mediator.

In sum, my research will establish a specific, mechanistic account of SES-based language disparities by precisely defining when and how these disparities arise. I will use a longitudinal study and mediation analyses[1] to evaluate a prediction-based model of language learning.[4] I will determine the developmental time-course of language disparities (Aim 1), and will deliver several novel findings. Specifically, I will be the first to: evaluate disparities in predictive language processing (Aim 2), evaluate which factors at 12 months predict language disparities at 18 months (Aim 2), and evaluate which mechanisms – language processing efficiency, predictive language processing, or both – mediate the input-learning relation (Aim 3). **Together, these findings will enable effective, targeted interventions for at-risk infants.**

Aim 1: Determine the developmental time-course of SES-based language disparities.
Hypothesis: Disparities in language input, language processing efficiency, and vocabulary size will be apparent at 12 months – 6 months earlier than prior reports.[1-2]
Participants: I will test 80 full-term infants from monolingual English-speaking households; 40 from Princeton, NJ (a high-SES area), and 40 from Trenton, NJ (a nearby low-SES area). I will test infants longitudinally, with assessments at 12, 18, and 24 months.
Methods: At 12 months, I will assess: SES, language input, language processing efficiency, and vocabulary size. I will assess SES via the Hollingshead Index.[1] I will assess infants' language input via Language Environment Analysis (LENA), in which infants wear a small digital recorder in their pocket for one typical day at home. I will analyze the number of adult words infants hear per hour.[1] I will assess language processing efficiency via an eye-tracking task.[1-2] Infants will see pictures on screen (e.g., a cookie, a book) and hear pre-recorded sentences (e.g., *Find the book*) while our eye-tracker automatically codes where infants look on screen. I will analyze the speed and accuracy of infants' looks to target (*the book*).[1-2] I will assess vocabulary size via the MacArthur-Bates Communicative Development Inventory (MCDI).[1-4]
Expected Results: Low-SES infants will have less language input, smaller vocabularies, and will be less efficient in language processing (i.e., slower and less accurate in eye-tracking).

Aim 2: Evaluate two specific disparities in language processing: language processing efficiency and predictive language processing.
Hypothesis: In addition to the established disparities in language processing efficiency,[1-2] there are also SES-based disparities in predictive language processing.[4]
Methods: At 18 months, I will assess vocabulary size via MCDI. I will assess language processing efficiency and predictive language processing via an eye-tracking task. In *control trials*, the verb is neutral (e.g., *Find the book*), whereas in *prediction trials*, the verb allows infants to predict the target (e.g., *Read the book*). To assess language processing efficiency, I will analyze infants' looks to target (*the book*) in control trials, as in Aim 1. To assess predictive language processing, I will analyze infants' looks to target in prediction trials. If infants use predictive language processing, they will be faster to look to target when the verb cues predictions to the target (*prediction trials*) than when the verb is neutral (*control trials*).
Expected Results: Low-SES infants will have smaller vocabularies, and will be less efficient in language processing, as in Aim 1 and as in prior studies.[1-2] Low-SES infants will also be less likely to use predictive language processing (i.e., they will not be faster to look to target in prediction trials than in control trials). Finally, disparities in language input, vocabulary, and language processing at 12 months will predict these disparities at 18 months.

Aim 3: Evaluate which disparities in language processing contribute to disparities in language learning: language processing efficiency, predictive language processing, or both.
Hypothesis: Language processing efficiency will mediate the input-learning relation, replicating prior results.[1] Predictive language processing will also be a mediator – a novel finding.
Methods: At 24 months, I will assess vocabulary size (MCDI) as our outcome variable and complete mediation analyses with infants' data from 12, 18, and 24 months.
Expected Results: Disparities in language processing efficiency at 18 months will mediate the relation between language input at 12 months and vocabulary size at 24 months, replicating prior results.[1] Critically, predictive language processing will be a mediator, supporting a prediction-based model of language learning.[4] That is, differences in predictive language processing, beyond differences in language processing efficiency, contribute to learning disparities.

Impact: My research explores the basic mechanisms of language learning in order to enable effective, targeted interventions for at-risk infants. Closing the language gap in infancy will help close the achievement gap in schools.[3] More immediately, this study will provide a meaningful research experience for my undergraduate mentees and for the participant families. We will discuss research directly with caregivers, allowing them to ask questions and be actively engaged in the scientific process. In sum, this investigation has implications for the estimated 1 in 5 children currently living in poverty,[3] as well as the broader society that cares for their wellbeing.

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